Patent Claims

1.   Arrangement for recording and reproducing images of an object to be examined having an illumination system, an image-generating recording system, and a controlling and evaluating computer, characterized in that the illumination system contains at least one illumination beam path with means for simultaneous illumination of the object to be examined by at least one reference wavelength region and at least one information wavelength region, in that the image-generating recording system has at least two color channels, and the reference wavelength region and information wavelength region are adapted to one color channel each so as to be received by the latter, and in that the at least one reference wavelength region is at least approximately invariant with respect to medically relevant information from the object to be examined, and the at least one information wavelength region is provided for detecting the medically relevant information.

2.   Arrangement according to claim 1, characterized in that the means for simultaneous illumination of the object to be examined have a wavelength-selective optical filter device which is arranged in the illumination beam path for filtering the totality of illumination light that is radiated for illuminating the object to be examined and which is constructed as a layer filter whose layer construction selects at least two narrow transmission regions serving as a reference wavelength region and an information wavelength region.

3.   Arrangement according to claim 2, characterized in that the layer filter is arranged in a parallel beam portion of the illumination beam path.

4.   Arrangement according to claim 1, characterized in that the means for simultaneous illumination of the object to be examined have a wavelength-selective optical filter device which comprises sector-shaped filter areas and is arranged in the aperture plane or in a plane of the illumination beam path conjugate to the aperture plane for filtering the totality of illumination light that is radiated for the illumination of the object to be examined.

5.   Arrangement according to claim 4, characterized in that the optical filter device comprises adjacent groups of filter areas and each group contains the filter areas for the wavelength regions to be selected.

6.   Arrangement according to one of claims 1 to 5, characterized in that the illumination system contains a continuously emitting illumination source and/or a strobe illumination source.

7. Arrangement according to claim 1, characterized in that the means for simultaneous illumination of the object to be examined have at least two variously selecting optical bandpass filters whose selected wavelength regions form the reference wavelength region and information wavelength region, and in that the bandpass filters are arranged in separate partial beam paths on the illumination side which proceed from a common illumination source and which are united to form a common beam path on the illumination side.

8. Arrangement according to claim 7, characterized in that at least one of the bandpass filters is constructed as a spectrally tunable bandpass filter whose control is connected to the controlling computer.

9. Arrangement according to claim 1, characterized in that the means for simultaneous illumination of the object to be examined have at least two illumination sources which emit in different wavelength regions and whose illumination light is combined in a common illumination beam path that is directed to the object to be examined in order to ensure identical geometric illumination characteristics.

10. Arrangement according to one of claims 1 to 9, characterized in that means for matching the intensity of the reference wavelength region and information wavelength region to the color channels are provided for optimal control of the image-generating recording system.

11. Arrangement according to claim 10, characterized in that the means for intensity matching are designed for variable intensities and have control units which are connected to the control computer so that the intensity matching between the wavelength regions can be carried out during operation.

12. Arrangement according to one of claims 1 to 11, characterized in that a multiple-chip color camera is provided as image-generating recording system.

13. Arrangement according to one of claims 1 to 11, characterized in that a single-chip color camera is provided as image-generating recording system.

14. Arrangement according to one of claims 1 to 13, characterized in that at least one device for stimulation or provocation of the object to be examined is provided for carrying out functional imaging.

15.   Arrangement according to claim 14, characterized in that a controllable optical light manipulator communicating with the controlling and evaluating computer is arranged in the illumination beam path for programmable modification of the intensity curve and/or time curve of a primary light coming from an illumination source, in that the modification has a temporally defined relationship with the adjustments of the illumination source and of the image recording and image evaluation, and in that a secondary light which is generated from the primary light by the modification is provided for illumination and for selective stimulation or provocation of the object to be examined.

16.   Method for detecting spatial and/or temporal medically relevant differences in anatomical structures of the eye as the object to be examined by means of an arrangement according to claim 1, characterized in that images of the anatomical structures are recorded simultaneously in the color channels associated with the reference wavelength region and information wavelength region provided on the illumination side, and in that secondary image values are generated from the images for at least one noise-reduced secondary image by combining the image values of image points that are conjugate to one another in the color channels, and these secondary image values are associated with the anatomical structures in the image in a positionally correct manner.

17.   Method according to claim 16, characterized in that an evaluation window is formed at least for one color channel, which evaluation window is moved over the image and comprises at least two adjacent image points whose gray values are combined by summing or averaging to form a window value before generating the secondary image values, and in that the secondary image values are generated from window values of the color channels that are conjugate to one another with respect to their window center points or from pixels of the color channels.

18.   Method according to claim 17, characterized in that the evaluation window is moved over the image by sliding and with window center points that are conjugate to one another.

19.   Method according to claim 17, characterized in that the evaluation window is moved over the image so as to be offset by more than one pixel in each instance, and a secondary image with reduced image points is accordingly generated.

20.   Method according to one of claims 17 to 19, characterized in that the

evaluation windows for the color channels have different window sizes, and the secondary image values are generated from window values whose window center points are conjugate to one another.

21. Method according to one of claims 17 to 20, characterized in that the linking of the image values of the evaluation windows that are conjugate to one another or pixels is carried out by division.

22. Method according to one of claims 16 to 21, characterized in that a secondary image sequence is generated from successively generated secondary images of identical image sections and is stored at least temporarily until the evaluation is concluded, wherein the secondary image sequence is generated with video standard in continuous illumination light but also as a strobe sequence in one or more sessions over longer intervals of time.

23. Method according to claim 22, characterized in that the secondary images belonging to an image sequence are spatially oriented to one another based on the offset and/or rolling and/or distortion of the original images.

24. Method according to claim 22 or 23, characterized in that characteristic values describing the functions of metabolism, vision or microcirculation or temporal or spatial changes between the secondary values of a secondary image sequence are determined from the secondary image sequences..

25. Method according to claim 24, characterized in that the characteristic values are associated with the anatomical structures in the original image in order to form functional images.

26. Method according to one of claims 22 to 25, characterized in that provoked or stimulated changes in metabolism, vision or microcirculation are recorded with the secondary image sequences.

27. Method according to one of claims 22 to 26, characterized in that the reference wavelength region and information wavelength region are changed during the generation of secondary image sequences by manually changing the wavelength-selective optical filter device or by controlling the spectrally tunable bandpass filters.

28. Method according to one of claims 22 to 26, characterized in that the matching of the intensities of the reference wavelength region and information wavelength region is

carried out manually or through the control computer during the generation of secondary image sequences in that feedback signals which control and optimize the matching of intensities are formed from the gray values of the color channels or from the secondary image values.

29. Image-generating method for detecting spatial and/or temporal medically relevant differences in anatomical structures and functional characteristics of an object to be examined which is illuminated to form images and is optionally stimulated or provoked, characterized in that the object to be examined is illuminated simultaneously by at least two wavelength regions of an illumination beam which are adapted each to one color channel of a color camera serving to record images, wherein one of the wavelength regions is at least approximately invariant with respect to medically relevant information, and another wavelength region is provided for detecting the medically relevant information, and in that at least one secondary image is generated from at least two images of the anatomical structures in that secondary image values which are associated in a positionally correct manner with the anatomical structures in one of the images are generated from image values of image points that are conjugate to one another in the color channels.

30. Image-generating method according to claim 29, characterized in that an evaluation window which is moved over the image is formed for each color channel, which evaluation window comprises at least two adjacent image points whose gray values are combined by summing or averaging to form a window value, and in that the secondary image values are generated from window values of the color channels, which window values are conjugate to one another.